

questions has to be asked alike on many planes—biological, psychological, economic, ethical, &c. Thus does every initiative in science open up a whole system of new lines of investigation. The student who gives himself to Dr. Tayler's guidance will be carried no little distance along several of these new lines of research; and, moreover, it will be surprising if, after that initiation, the student does not himself acquire the momentum of original investigation, for evolutionist conceptions are applied by Dr. Tayler with a fertility and a novelty as courageous as their results are inspiring.

His evolutionist doctrines cannot be adequately summarised in the space here available. But two of his main contentions may be noted. Looking at western civilisation from the environmental point of view, he sees two large formative processes at work. There is a process which operates in the direction of selecting the palæogenic types and eliminating the neogenic; and there is a process which sociologically runs counter to this, and operates in the contrary direction, tending to select the neogenic types and eliminate the palæogenic. The social environment which, in its characteristic domestic and occupational phases, pertains to the plutocratic and the aristocratic scheme of life is, in point of selective efficacy, stated to be the sociological equivalent of the disease and poverty, the crime and vice of the urban slums. In contrast to the social selection exercised alike by impoverished and luxurious environments, Dr. Tayler finds the counter process in the cultural activities associated with most professional and some artisan occupations.

Such being the speculative foundations, it will be readily seen that Dr. Tayler's practical policy of social progress lies in environmental modification consciously planned by the scientific sociologist. The immediate practical question thus resolves itself into asking who and where is the scientific sociologist and what are his credentials? The human control of environmental modification has hitherto—at any rate since the Reformation—lain with the statesman and politician, and such theoretical guidance as the practical reformer has received from theologian and historian, and in later times from economist and journalist, has not been without a certain element of scientific foundation. But the guidance of a new spiritual order is appearing. Indications of this are visible on all sides. To say nothing of Mr. Wells and other competent popularists, examples may readily be drawn from more recondite sources. By the president of the Scottish College of Physicians, medical men were recently exhorted, with missionary fervour, to organise a crusade for the development of a hygienic conscience. From the rostrum of the Sociological Society Mr. Galton has preached a eugenic conscience. A recent presidential address of the Anthropological Institute came very near to preaching an ethnic conscience; and have not the psychologists for half a generation or more been preaching a pedagogic conscience?

It is indeed manifest that we are here in contemplation of that most thrilling spectacle of human drama

—the birth-throes of a new spiritual power. And in the new spiritual orders there will be, as always in the past there have been, individuals of the militant type—brethren not content with crook and cassock, book and bell, but demanding the sword of temporal power. In this respect the observation may be made that great as is the theoretical and scientific interest of Dr. Tayler's book, yet its practical symptomatic interest is perhaps still greater; for it is diffused with the militant spirit, and thus it becomes a matter of political concern to ascertain how many fighting brothers of Dr. Tayler's calibre are to be found in the order of the Neo-æsculapians.

ELECTRICITY, OLD AND NEW.

Propagation de l'Electricité. By Marcel Brillouin. Pp. vi+398. (Paris: A. Hermann.) Price 15 francs.

IN this book we have a reproduction of a course of lectures delivered by Prof. Brillouin at the Collège de France during the session 1902-03. They were presumably addressed to an audience possessing already a fair knowledge of electrical theory. The author, therefore, does not aim at giving a complete and connected account of the subject, but, with a freedom which less fortunate teachers will envy, selects those parts which seem to him most interesting from a historical or theoretical point of view. The subject matter of the course now published falls under two heads; first, an exposition of fundamental principles, characterised by great fulness in the historical setting and originality in the order adopted, and second, a detailed discussion of certain special problems. The style is admirably clear, and the whole book is written with a freshness which makes it very interesting reading.

The title is taken to cover steady as well as varying currents. Accordingly, the first four chapters are devoted to an account of the work of the pioneers, beginning with Cavendish—that wonderful human electrometer who estimated P.D. by the kick in his elbows—and coming down to Kirchhoff and Clausius. The author traces very clearly the gradual progress towards definiteness in the ideas of the magnitudes which figure in Ohm's law. Of Ohm's work a specially full account is given; stress is laid upon the fact that Ohm, in formulating his theories, was influenced constantly by the desire to coordinate experimental results, and was not, as is sometimes represented, guided merely by an *a priori* analogy between thermal and electrical phenomena.

Following this historical introduction we have the development of the theory of conduction in three dimensions. Among the special cases dealt with are the resistance of a circular cylinder treated by Bessel's functions, and the "end-correction" for a wire by Lord Rayleigh's method of approximations.

The discussion of varying currents is next taken up, beginning with the case in which the influence of capacity only needs to be considered. An excellent account is given of Lord Kelvin's theory of the cable.

The author, here and elsewhere, keeps in close touch with the actual experimental conditions, and makes frequent reference to the historic controversies of the early days of long-distance signalling. This chapter is followed by an account of the author's investigation of the electrostatic field associated with a given current system. An interesting special case is worked out in detail, viz., the two-dimensional field produced by a current sheet flowing round an infinitely long cylinder, an impressed E.M.F. being localised in a generator.

In the treatment of induced currents which follows, Prof. Brillouin departs widely from the order of ideas now usually adopted. He confines the discussion to fixed circuits in a uniform non-magnetic medium, and takes as starting point Felici's experiments on the induction of currents in a secondary circuit, by making or breaking a given current in a primary. Proceeding in the old action-at-a-distance manner, he gets first a formula for the inductive action of an element of the primary circuit on an element of the secondary, and from this obtains the coefficient of mutual induction and the vector potential. Some cases of induction coefficients are worked out, and then follows an exhaustive and critical analysis of Kirchhoff's great memoir of 1857, in which the finite rate of propagation of electric effects along a wire was established.

Perhaps the most novel feature of the book, at least to an English reader, is the way in which the question of open circuits is approached. The author begins by adding to his vector potential a term which goes out on integrating round a closed path. This term is affected by an arbitrary constant which appears also in the complete electric force derived from the new vector potential. The value of this constant is then chosen so as to make the divergence of the electric force still equal to 4π times the charge. This preserves what the author calls the "unity of the electric force," i.e., it makes the ponderomotive force on unit charge identical with the current-producing force which enters into Ohm's law. When we have reached this point we find that the new term in the vector potential has given us Maxwell's displacement current. It is then shown that its identification as a true current makes all currents closed, and is justified by its electromagnetic effects. The magnetic force is then introduced "pour la commodité de langage," as the vector the time-rate of which is the curl of electric force; and such things as magnet-poles need not exist at all.

To readers brought up on Maxwell and Heaviside this electrostatic method of arriving at things will come as a sharp disturbance to the "normal piling" of their electrical ideas. A similar disturbance would be produced in the theory itself by the introduction of a little iron into its system. We shall probably understand the reason for the adoption of this procedure if we remember that Prof. Brillouin wrote when "l'affaire Crémieu" was at its height, and before Pender crossed the Atlantic to see what the matter was. An exposition which linked Maxwell's

views to the earlier theories was specially natural at that time, in view of the doubts suggested touching relations which had come to be regarded as the "solid ground of Nature." If a revision of belief had been shown to be necessary, some such harking-back to earlier positions as is displayed in the present book would have become essential.

The concluding section of the lectures is occupied with a discussion of the problems of the Hertz oscillator and of the oscillations proper to spherical and spheroidal conductors. A full account is given of the recent work of Prof. Pearson and Miss Lee on the field of the Hertzian doublet as modified by the damping of the oscillations. In the discussion of the spheroid the author supplements the work of Abraham and Maclaurin, specially in the direction of numerical evaluation of the functions involved.

W. B. M.

MILK IN RELATION TO DISEASE.

Bacteriology of Milk. By Harold Swithinbank, of the Bacteriological Research Laboratory, Denham, and George Newman, M.D., D.P.H., Medical Officer of Health of the Metropolitan Borough of Finsbury, and formerly Demonstrator of Bacteriology in King's College, London. With special chapters also by Dr. Newman on the Spread of Disease by Milk and the Control of the Milk Supply. Pp. xx+605; illustrated. (London: John Murray, 1903.) Price 25s. net.

THE public is beginning to recognise the importance of milk and its products from the dietetic and hygienic point of view, and public authorities are becoming alive to the necessity for safeguarding the milk supply from adulteration, from the addition of preservatives, and from contamination with filth and the germs of disease. The appearance of this work, a large volume of 600 pages, is therefore opportune. It is a treatise on milk in its relation to disease rather than, as its title implies, an account of the general bacteriology of milk, for while such subjects as the souring of milk and the various fermentations it undergoes are dealt with in 55 pages, tuberculosis in relation to milk, epidemics of disease due to infected milk, the legal enactments regulating milk supply, &c., occupy some 350 pages.

As a general criticism, in the reviewer's opinion some of the matter introduced might without detriment have been omitted, thereby giving more space to certain subjects that at present receive somewhat scant treatment. Thus an attempt has been made to deal generally with bacteriological technique, the preparation of culture media, and examination of water and air, instead of limiting the matter in these directions to that special to the subject. The pages on the agglutination reaction, on preventive inoculation in enteric fever, and on the bacteriological diagnosis of diphtheria seem to be quite unnecessary. The chapter on the description of species of milk bacteria, occupying some 60 pages, also gives for the majority